The Biology of Blood-Sucking in Insects
Second Edition

Blood-sucking insects transmit many of the most debilitating diseases in humans, including malaria, sleeping sickness, filariasis, leishmaniasis, dengue, typhus and plague. In addition, these insects cause major economic losses in agriculture both by direct damage to livestock and as a result of the veterinary diseases, such as the various trypanosomiases, that they transmit. The second edition of *The Biology of Blood-Sucking in Insects* is a unique, topicled commentary on the biological themes that are common in the lives of blood-sucking insects. To do this effectively it concentrates on those aspects of the biology of these fascinating insects that have been clearly modified in some way to suit the blood-sucking habit. The book opens with a brief outline of the medical, social and economic impact of blood-sucking insects. Further chapters cover the evolution of the blood-sucking habit, feeding preferences, host location, the ingestion of blood and the various physiological adaptations for dealing with the blood meal. Discussions on host–insect interactions and the transmission of parasites by blood-sucking insects are followed by the final chapter, which is designed as a useful quick-reference section covering the different groups of insects referred to in the text.

For this second edition, *The Biology of Blood-Sucking in Insects* has been fully updated since the first edition was published in 1991. It is written in a clear, concise fashion and is well illustrated throughout with a variety of specially prepared line illustrations and photographs. The text provides a summary of knowledge about this important group of insects and will be of interest to advanced undergraduate and to postgraduate students in medical and veterinary parasitology and entomology.

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SECOND EDITION

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Preface

Blood-sucking insects are the vectors of many of the most debilitating parasites of humans and their domesticated animals. In addition they are of considerable direct cost to the agricultural industry through losses in milk and meat yields, and through damage to hides, wool and other products. So, not surprisingly, many books of medical and veterinary entomology have been written. Most of these texts are organized taxonomically, giving details of the life cycles, bionomics, relationships to disease and economic importance of each of the insect groups in turn. I have taken a different approach. This book is topic-led and aims to discuss the biological themes common to the lives of blood-sucking insects. To do this I have concentrated on those aspects of the biology of these fascinating insects that have been clearly modified in some way to suit the blood-sucking habit. For example, I have discussed feeding and digestion in some detail because feeding on blood presents insects with special problems, but I have not discussed respiration because it is not affected in any particular way by haematophagy. To reflect this better I have made a slight adjustment to the title of the book in this second edition. Naturally there is a subjective element in the choice of topics for discussion and the weight given to each. I hope that I have not let my enthusiasm for the particular subjects get the better of me on too many occasions and that the subject material achieves an overall balance. The major changes in this second edition most often reflect the revolutionary influence that molecular biology has had on the subject in the past 12 years.

Although the book is not designed as a conventional text of medical and veterinary entomology, in Chapter 9 I have given a brief outline of each of the blood-sucking insect groups. This chapter is intended as a quick introduction for those entirely new to the subject, or as a refresher on particular groups for those already familiar with the divisions of blood-sucking insects. There are several introductory textbooks of medical and veterinary entomology available to those requiring more information.

The book is primarily intended for advanced undergraduate and for postgraduate students, but because it looks at topics that cut across the normal research boundaries of physiology and ecology, behaviour and cell biology, I hope it may also be useful for more established scientists who

want to look outside their own specialism. I have tried to distil this broad spectrum of information, much of which is not readily available to the non-specialist, into a brief synthesis. For those who want to look further into a particular area I have included some of the references I found most useful in writing the text, and these will provide an entry into the literature. Clearly the subjects covered by the book encompass a vast number of publications and I am sure to have missed many important and interesting references for which I apologize in advance both to the reader and my fellow scientists. Many of the topics discussed in the different chapters are interrelated. To avoid repetition, and still give the broadest picture possible, I have given cross-references in the text which I hope the reader will find useful.

From a comparative point of view it is an unfortunate fact that most of the work on blood-sucking insects has been carried out on a few species. Consequently, tsetse flies and mosquitoes pop up on every other page. In many instances it remains to be seen how widely the lessons we have learned from these well-studied models can be applied. Where possible I have tried to point to general patterns that fit whole groups of blood-sucking insects. To help me in this I have divided the blood-sucking insects into three convenient but artificial categories: temporary ectoparasites, permanent ectoparasites and periodic ectoparasites. These categories are based solely on the behaviour biology of the blood-feeding stadia in the lives of these insects. Temporary ectoparasites are considered to be those largely free-living insects, such as the tabanids, mosquitoes, blood-feeding bugs and blackflies, that visit the host only long enough to take a blood meal. I also include insects such as the tsetse here, even though the male may be found in swarms closely associated with the host for large parts of its life. Permanent ectoparasites are considered to be those insects that live almost constantly on the host, such as lice, the sheep ked and tungid fleas. Finally, periodic ectoparasites are considered to be those insects that spend considerably longer on the host than is required merely to obtain a blood meal, but that nevertheless spend a significant amount of time away from the host. Insects that fall into this category include many of the fleas and Pupipara. These categories are no more than a useful generalization in the text; I make no claims for their rigour and I realize that it could be argued in several instances that an insect will sit as easily in one category as another.

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